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Libya's Nuclear Program: Problems Continue

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An Intelligence Assessment

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An Intelligence Assessment

This paper was prepared by [] Office
of Global Issues. Comments and queries are welcome
and may be addressed to the Chief, Weapons
Proliferation Branch, OGI, []

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This paper was coordinated with the Directorate of
Operations and the National Intelligence Council. []

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**Libya's Nuclear Program:
Problems Continue**

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Key Judgments*Information available
as of 25 March 1983
was used in this report.*

Libyan leader Mu'ammar Qadhafi is intent on developing a nuclear energy program that could eventually provide a nuclear weapons capability. His dedication to this goal is evidenced by:

- His general interest in acquiring advanced technology that can be used to enhance Libya's national security.
- His public statements about the specific need for Arab states to counterbalance Israel's nuclear capability.

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To gain a nuclear weapons capability, the Libyans have tried to acquire nuclear materials and technology clandestinely and have launched a domestic nuclear energy program.

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The current emphasis on building a domestic nuclear energy program suggests the Libyans now hope to acquire a complete fuel cycle that would eventually enable them to produce fissile material.

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Efforts to obtain and absorb nuclear technology relevant to the fuel cycle have registered little progress and continue to face serious obstacles. The Libyans currently lack the technical infrastructure and skilled manpower to operate even the small Soviet-built research center that was completed at Tajura last year. They have sought assistance from the Soviets, the Finns, and the Belgians, although as yet no additional nuclear supply contracts have been finalized. The Libyan nuclear program suffers from other constraints as well:

- A loss of revenues, resulting from the depressed oil market, has made it more difficult for the Libyans to pay for nuclear technology, particularly the exorbitant price asked by the Soviets for their power reactors.
- Libya's attempts to use oil exports as a lever to persuade nuclear suppliers to provide assistance and technology have been unsuccessful, and the current oil glut reduces Libya's bargaining power.
- West European suppliers, with the exception of the Belgians, remain wary of doing business with Qadhafi because of his reputation for erratic policies.
- Developing countries that the Libyans have approached for nuclear assistance are limited in what they are able or willing to provide.

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Qadhafi's pursuit of a nuclear weapons capability will continue to pose a proliferation threat. The Soviets were instrumental in persuading Libya to sign the Non-Proliferation Treaty and to place the nuclear research program under IAEA safeguards. However, Moscow's willingness or ability to ensure effective safeguards coverage in the future is uncertain.

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[REDACTED] We believe, nevertheless, that the numerous technical and financial constraints will prevent Libya from producing fissile material in sufficient amounts for a nuclear device at least in this decade and possibly much longer. [REDACTED]

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Libya's Nuclear Program: Problems Continue

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Introduction

Libyan leader Mu'ammar Qadhafi began promoting the establishment of a nuclear program soon after coming to power in 1969. His motivation from the beginning—as reflected in his public statements—has been twofold: a desire to establish the credentials of a modern, technologically advanced state and to acquire a nuclear weapons capability that would match the nuclear option Israel is widely believed to possess. Progress toward these objectives was thwarted for a long time. Qadhafi's highhanded and self-aggrandizing behavior undermined early cooperative ventures with Egypt to establish a nuclear power and water desalinization program. More importantly, periodic reports of Qadhafi's efforts to purchase clandestinely or steal a nuclear weapon have branded him a potentially dangerous actor in the nuclear arena and have also contributed to Libya's difficulties in persuading nuclear supplier states to provide technology for a nuclear program.¹ Moreover, intermittent attempts to use the oil lever to persuade nuclear supplier states and even some developing countries, such as India, to provide nuclear assistance have not produced significant results.

This intelligence assessment focuses on the Libyan effort to develop a domestic nuclear energy program. The paper assesses Libyan plans to acquire a complete nuclear fuel cycle, particularly Tripoli's efforts to persuade Western nuclear suppliers, such as the Belgians, to provide sensitive nuclear facilities. This assessment does not examine in detail whether the Libyans will be able to obtain a nuclear weapons capability through clandestine acquisition efforts. Such efforts probably will continue but, by all accounts, have been unsuccessful thus far.

¹ Qadhafi's most publicized effort to acquire a nuclear weapons capability was his alleged financial investment in the Pakistani nuclear program. Relations between Libya and Pakistan have deteriorated since President Zia replaced Bhutto in 1977, and Islamabad is unlikely to share any weapons-grade fissile material that it might produce.



Col. Mu'ammar Muhammad Qadhafi of
Libya

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A Slow Start

Despite Qadhafi's unwavering interest, efforts to build a domestic nuclear program in Libya did not begin until the early 1970s, when increased oil revenues made a nuclear program a practical undertaking. The Libyan Atomic Energy Commission was established in 1973, and, as did many other developing nations with an interest in nuclear technology, the Libyans emphasized the peaceful goal of energy independence. Nuclear energy was justified as a necessity

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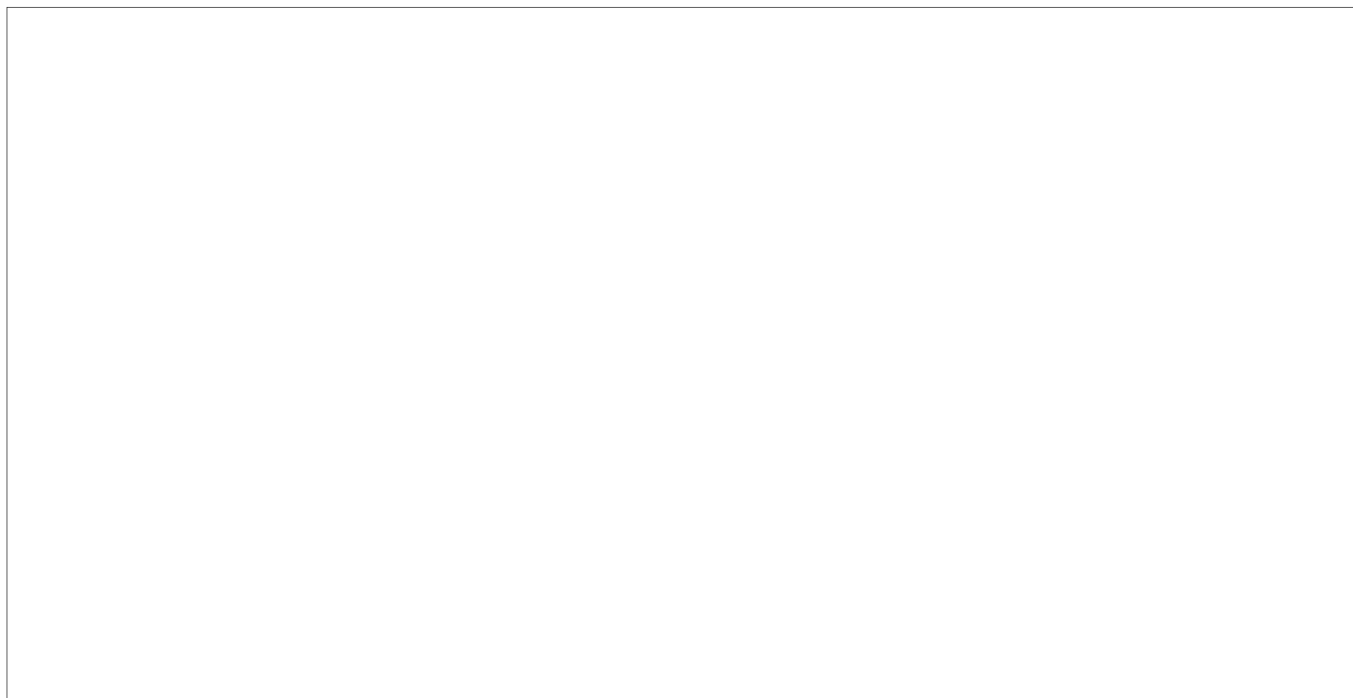
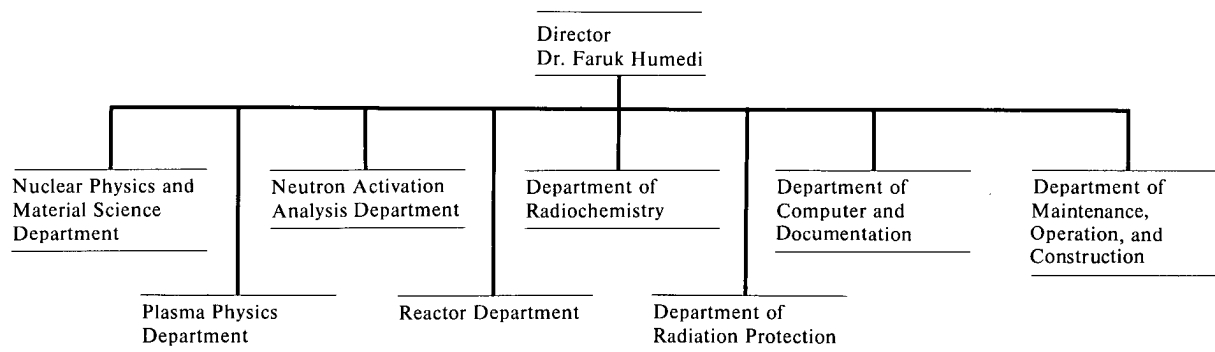


Figure 1
Tajura Nuclear Research Center



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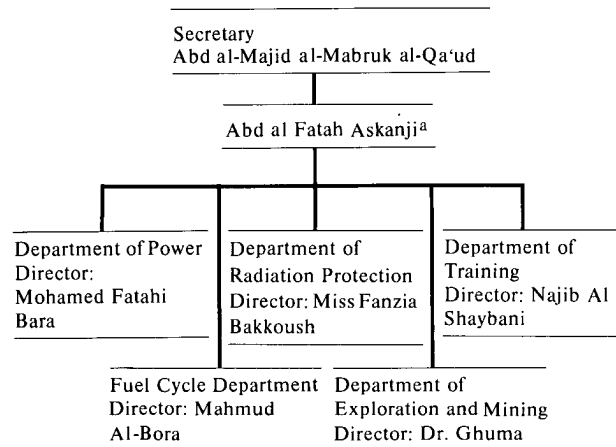
to ease the economic burden once Libya's oil reserves were depleted, an event that international petroleum experts believe could occur before the end of this century. []

In devising a domestic nuclear program, the Libyans, in our view, were methodical in their approach, choosing not to shop for large nuclear power reactors until they had acquired nuclear research facilities. Still little progress was made until the mid-1970s when Tripoli, after years of avoiding a close relationship with the USSR, turned to Moscow for military aid and nuclear technology out of what we believe was a perception that they could never be acquired from the West. The Soviets agreed in 1977 to build, equip, and train the personnel to run a multimillion-dollar nuclear research center at Tajura, 30 kilometers east of Tripoli.² []

Construction of the Tajura center, which includes a small Soviet-built 5- to 10-megawatt research reactor, began in 1977, but political factors delayed completion of the center until late 1982. To meet a Soviet precondition for the technology transfer, Libya had signed the nuclear Non-Proliferation Treaty (NPT) in 1975 and had agreed to accept International Atomic Energy Agency (IAEA) safeguards over all nuclear activities. However, Libya procrastinated in concluding a safeguards agreement with the IAEA to cover the research center, and in response the Soviets slowed construction to express displeasure. Tripoli finally concluded the safeguards agreement with the IAEA in July 1980. The research reactor at the center achieved initial criticality in September or October 1981 but was shut down after only a few weeks because of technical problems. []

² A number of Western firms from Austria, France, Japan, Switzerland, the United Kingdom, and West Germany have served as subcontractors for specific equipment. []

Figure 2
Libyan Secretariat of Atomic Energy



^a Although replaced by Qa'ud as leader of Libya's nuclear establishment in January 1981, Askanji administers the Secretariat's liaison office for IAEA affairs and heads the team that is negotiating a contract with the Soviets for the purchase of two nuclear power reactors.

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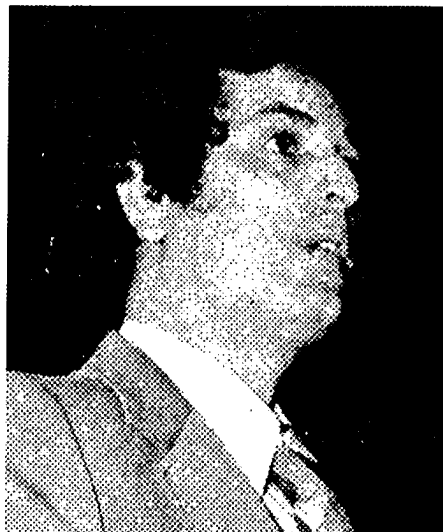
Lessons Learned

The experience of starting a nuclear research program forced the Libyans to address serious technical problems and shortcomings. Libyan nuclear officials took steps in the late 1970s to grapple with a major shortcoming, a severe shortage of qualified nuclear scientists. A new College of Nuclear Engineering was established under the auspices of Al-Fatah University in Tripoli, and large numbers of students were also sent abroad. The US press estimates that at least 23 Libyan students are enrolled in programs relating to nuclear science and engineering at universities in the United States. Additional press reports estimate that there are 200 to 300 such students in various West European universities and at least 50 more in the Soviet Union and Eastern Europe. []

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'Abd al-Majid al-Mabruk al-Qa'ud

Secretary of Atomic Energy 'Abd al-Majid al-Mabruk al-Qa'ud is a confidant and longtime supporter of Qadhafi and owes his present assignment to this personal relationship rather than to his expertise. Qa'ud, an engineer by training, has held other senior government posts. He was mayor of Tripoli, 1971-79; Minister of State for Agricultural Development, 1972-79; and Secretary for Liaison, a post in which he acted as a middleman between Qadhafi and the Cabinet, 1979-81. Although Qa'ud expressed pro-Western views in the early 1970s, he now toes Qadhafi's anti-American line. He is also distrustful of the Soviets. [redacted]



Furthermore, Qadhafi in early 1981 reorganized the nuclear establishment in an apparent effort to give the nuclear program a greater sense of direction and momentum. Specifically, the Ministry of Atomic Energy was upgraded to the level of a secretariat to signify cabinet-level status. Qadhafi also selected a trusted political adviser, Abd al-Majid al-Mabruk al-Qa'ud, to administer the new Secretariat of Atomic Energy (SAE). Formerly, the program had been directed by a technical specialist, Abd al-Fatah Askanji, who headed the old Ministry for close to six years.³ [redacted]

Perhaps the most important consequence of the effort to launch a nuclear research program was that the experience reinforced for the Libyans the realization that they would be almost totally dependent on outside assistance for their more ambitious plans for a nuclear power program. Libyan reliance on foreign assistance for the safe operation of the small research reactor at Tajura has underscored Tripoli's lack of trained technical personnel. The Libyans do not have

³ Qadhafi's long reliance on Askanji may have been influenced by his previous bad experience in putting a nuclear program into the hands of a political figure. Askanji had replaced 'Umar Muhayshi, a political adviser to Qadhafi who was forced into exile after attempting an unsuccessful coup in 1975. Qadhafi's decision to turn to Qa'ud (who is his wife's uncle as well as a former mayor of Tripoli) suggests that the Libyan leader is now relatively confident that Qa'ud does not pose a similar threat. [redacted]

the capability to design and construct the facilities envisioned for the larger nuclear program nor do they have enough technicians to operate such facilities. [redacted]

The Projected Nuclear Power Program

Recognizing the need for outside help to continue the nuclear program, Libya has made overtures to several suppliers. The most extensive contacts have been with the USSR, Finland, and Belgium. Overtures have been made to various Third World suppliers as well, but as yet little has resulted from such efforts. [redacted]

Soviet assistance in building the Tajura research center encouraged the Libyans to attempt to acquire other parts of the nuclear fuel cycle from the Soviets. Various press reports indicate that Tripoli has been negotiating for several years for the construction at Surte of two Soviet-designed 440-megawatt light water power reactors and a large seawater desalinization plant. The projected price tag for the two power reactors and the desalinization plant is about \$4.5 billion—double what we estimate the package would cost from Western firms. [redacted]

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Because of the exorbitant Soviet price tag for the reactors, the longstanding plan to select Soviet reactor technology for the commercial power program has gradually become a controversial issue among Libyan nuclear officials. [REDACTED]

cooperation with Tripoli in mid-1981. [REDACTED]

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SAE officials have attempted, during the past two years, to assure themselves that Libya obtains the best nuclear power reactor design for the money. In their search for an independent evaluation of Soviet power reactor technology, SAE officials sought the Finns as consultants. We believe this approach was taken not only because Finnish firms were being considered as subcontractors for the Libyan nuclear power project but also because the Finns have firsthand experience in operating Soviet power reactors. [REDACTED]

In view of Finland's reluctance to become deeply involved in the nuclear power program, the SAE has for some time sought other consultants. Its most significant contact has been with the Belgian conglomerate, Belgonucleaire, which served as a consultant for planning the Tajura center. The Libyans have drawn upon Belgian expertise and advice during the protracted commercial nuclear reactor negotiations with the Soviets. [REDACTED]

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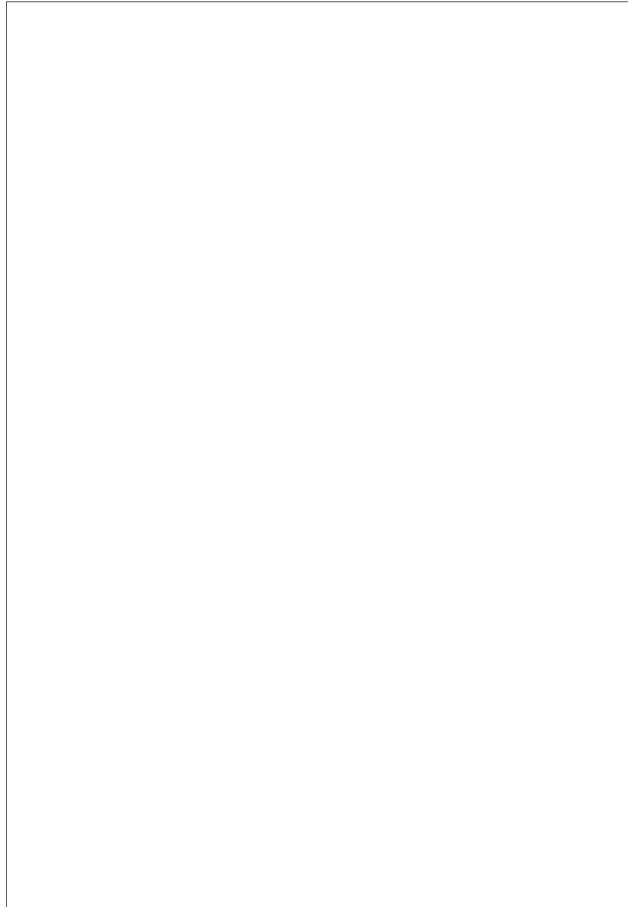
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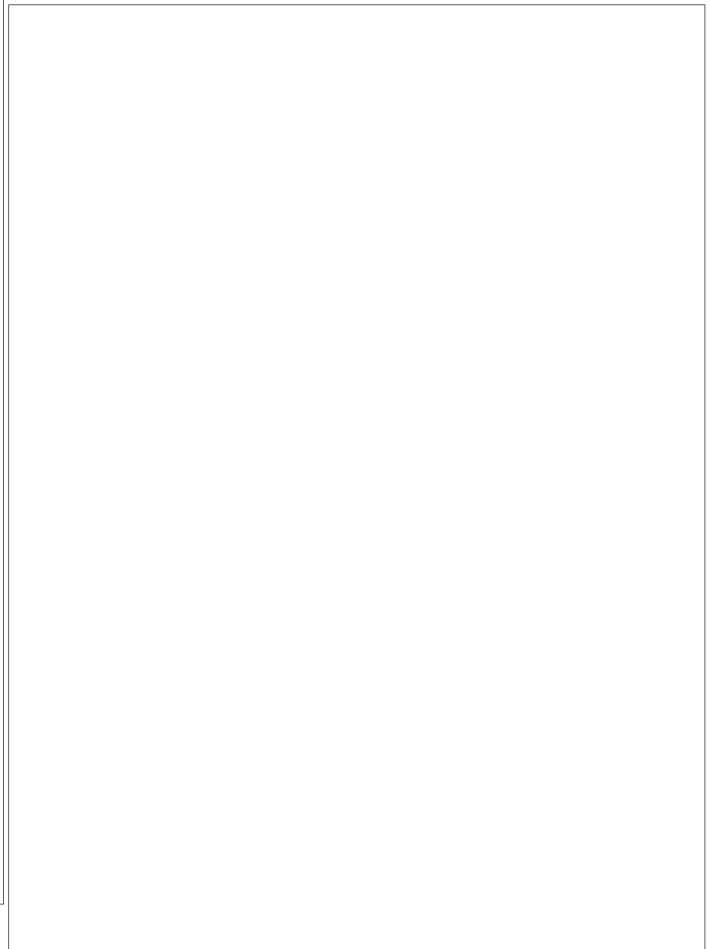
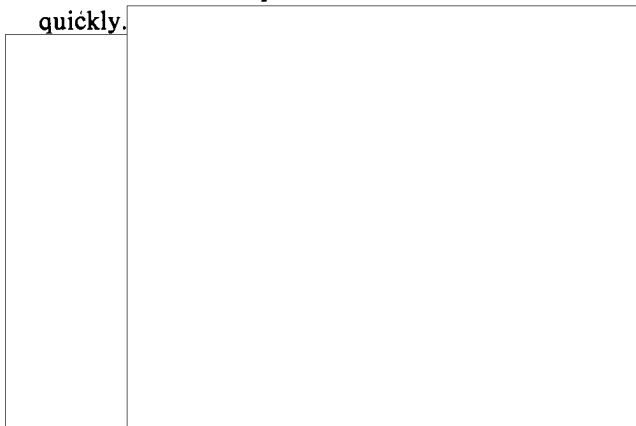
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The Finns were in a good position to provide a comparative analysis of the Soviet reactors that Libyan political leaders have insisted on buying. However, Helsinki broke off discussions on all aspects of nuclear

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Press reports indicate that the subject of nuclear cooperation and, most likely, the reactor contract emerged in Qa'ud's talks with the Soviets during the visit of a high-level Libyan delegation to Moscow in mid-March. We do not yet know the results of these discussions, but we continue to believe that the Libyans are under little pressure to conclude a contract quickly.



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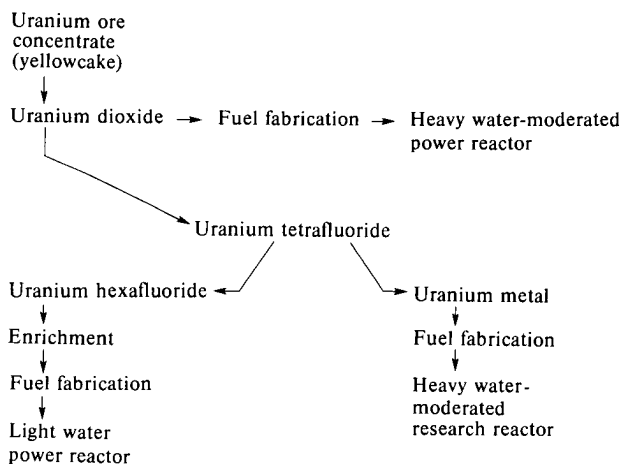
The Proliferation Risk

The likelihood that Belgium will build a UF₄ facility for the Libyans raises questions about the proliferation risk associated with this technology. A uranium tetrafluoride plant would give Libya an essential piece of the nuclear fuel cycle. Uranium tetrafluoride is an intermediate step in the production of either uranium hexafluoride or uranium metal. The former is used as feed material for enriching uranium, possibly to a grade sufficient for use in a nuclear weapon. Uranium metal can be used as nuclear fuel for heavy water-moderated research reactors. Such reactors can serve

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Figure 4
Nuclear Fuel Cycle



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as efficient producers of weapons-grade plutonium.⁴ Also, highly enriched uranium metal can be used directly in a nuclear weapons device. [REDACTED]

The Belgian Government and Belgonucleaire have strongly defended their actions in response to US requests that Brussels cancel the projected contract. They have repeatedly argued with US officials that this transfer of nuclear technology does not pose a major proliferation risk.⁵ They insist that the contemplated transfer to Libya only provides expertise in the handling and conversion of uranium compounds and not uranium metal. The Belgians also emphasize that the Libyans do not have the ability to enrich uranium—for use as reactor fuel or for weapons applications—and lack the technical expertise to misuse the

⁵ There is an international consensus that a UF₆ plant by itself is not sufficiently sensitive to require nuclear safeguards. Indeed, the IAEA does not have a regular system for monitoring the output of such facilities. [REDACTED]

materials and equipment supplied by Belgonucleaire.

The Belgian Government rationalizes its decision on the grounds that if Belgonucleaire does not supply such technology some other foreign nuclear firm will.

We believe that the Libyan nuclear program will pose a serious proliferation threat only if Tripoli acquires several other basic nuclear technologies necessary for the production of weapons-grade fissile material. Specifically, the Libyans must either obtain a reactor that can produce a significant amount of plutonium or acquire the ability to produce highly enriched uranium. The latter possibility seems remote to us because the Libyans are unlikely to persuade any nuclear supplier state to provide enrichment technology, though they might conceivably buy or steal highly enriched uranium through clandestine channels. If Libya acquires the Soviet power reactors, those could eventually provide enough plutonium, but Tripoli would still need the technology to reprocess significant amounts of spent fuel. The Libyans do not even have the ability to reprocess the spent fuel from their small research reactor at the Tajura center.

Other Proliferation Issues

Despite major technical obstacles to Libyan efforts to acquire a nuclear weapons capability, at least three issues have generated concern among Western nuclear supplier states about Qadhafi's nuclear program:

- The trustworthiness of the Soviets in ensuring the adequacy of safeguards for Libya's nuclear program.

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The UF, Facility: The Proliferation Risk

The Libyans do not currently have the technology to convert uranium tetrafluoride to uranium metal or uranium hexafluoride, but they appear determined to acquire the technologies that would enable them to master all aspects of uranium conversion and fuel fabrication.

The Libyans have another option should Belgonuclear provide them with the most common conversion method—the wet process. Uranium dioxide (UO₂) produced as an intermediate stage would be sufficiently pure and in the proper form to be made into pellets for nuclear fuel in a heavy water power reactor. Such a reactor could be used to produce weapons-grade plutonium for a nuclear device.

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We have no evidence that the Libyans have sought a supplier for a heavy water research or power reactor. The Libyans might try to acquire the Italian-designed Cirene-type research reactor, which also can be fueled with natural uranium dioxide pellets.

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Should the Libyans acquire the technology to convert uranium tetrafluoride to uranium metal, they could use it to fuel a heavy water research reactor that can generate significant amounts of plutonium.

There are only two potential suppliers of a heavy water power reactor—Canada and West Germany—but neither are likely to approve such a transfer, particularly in the face of strong US objections.

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- Libya's failure to report all its purchases of yellowcake to the IAEA.
- Tripoli's apparent interest in promoting nuclear cooperation with other potential proliferators.

safeguards at the Tajura research center remains a legitimate issue because the Soviets have been less than candid about specific aspects of their supply relationship with the Libyans. The Soviets initially informed US officials that Libya would be given 2.5 to 3.0 kilograms of 40- to 50-percent enriched uranium to run the research reactor at the center. In December 1980 the Libyans and the Soviets notified the IAEA of the shipment of fuel; however, the amount was 11 kilograms and it was 80-percent enriched. State Department reports indicate that this material was delivered before the IAEA and Libya had reached a detailed safeguards agreement for Tajura. In discussions with US officials, the Soviets have refused to acknowledge any discrepancy in their statements about the amount and nature of the nuclear material. They now justify the 11 kilograms on the grounds that it was required to fuel the small zero-power critical facility at Tajura as well as the 10-megawatt research reactor.

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The Safeguards Issue

The Soviets have been instrumental in persuading the Libyans to accept international safeguards and are responsible for seeing that Tripoli honors this commitment. Moreover, no other supplier state—not even Belgium—is in a position to monitor Libyan activities as closely as the Soviet Union. In view of Qadhafi's well-known interest in eventually acquiring a nuclear weapons capability, it is vital that Moscow maintains what has been a longstanding record of compliance with its obligations under the NPT and as a member of the London Suppliers Group.⁶

Despite the generally good record of Soviet efforts to ensure safeguards coverage in Libya, the adequacy of

⁶ The Soviet Union is obligated as a member of this supplier's organization to consult with other suppliers before exporting nuclear material, equipment, or technology and to insist on IAEA safeguards for all transfers.

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Furthermore, the Soviets have waffled on an earlier commitment to take back all the reactor's spent fuel—a traditional Soviet practice with other customers and an explicit provision in the 1976 Soviet-Libyan nuclear cooperation agreement. The Soviets have rationalized this departure from their traditional policy in assertions to US officials that the amounts of plutonium and highly enriched uranium remaining in the spent fuel would be too small to pose a threat.

Attempting to allay US concerns, Moscow has left open the possibility that it might take back the spent fuel to reprocess if this step appears to be financially profitable. More importantly, the Soviets have told US officials of a fallback safeguards arrangement, which they say will ensure that all Soviet-supplied fuel will remain under safeguards even if Libya renounces the NPT. The Soviets insist that in such an eventuality, bilateral safeguards will be even more stringent than those currently administered under the IAEA.

Damage resulting from Soviet actions has thus far been slight because the amounts of fissile material and spent fuel are too small to constitute a serious proliferation threat. The Libyans would require substantially more than 11 kilograms of highly enriched uranium at the 80-percent enrichment level to develop a nuclear device, and the Soviets are correct in asserting that the reactor's spent fuel will not contain significant amounts of plutonium. Furthermore, even though the fuel was shipped prior to an IAEA inspection of the Tajura center, IAEA inspections have subsequently accounted for the Soviet-supplied nuclear material. The first IAEA inspection took place in November 1981.

It remains unclear how trustworthy the Soviets will prove to be in their dealings with the Libyans over the long run. There is no reason to believe that they will ship additional enriched uranium to the Tajura center soon because the reactor has more than enough fuel for the near term. Should Moscow secure a contract to construct the two power reactors, the Soviet policy on the disposition of the much larger amounts of spent fuel generated by these nuclear facilities would be important.

The Uranium Stockpile

Another cause for concern has been the evidence that Libya has reneged on its commitments as a signatory to the NPT to report all its uranium purchases to the IAEA. Since late 1978, Tripoli has purchased almost 2,000 tons of uranium ore concentrate (yellowcake) from Niger, which issues public reports on its exports.

US officials have approached the Soviets concerning Libya's failure to honor this NPT commitment. Soviet officials in discussions with their US counterparts have adopted a relaxed attitude, essentially dismissing US concern as a reflection of Washington's "paranoia" regarding Qadhafi. They acknowledge that failure to notify the IAEA of yellowcake transactions is a violation of the NPT obligation but only in the most "formal" sense. They maintain that it is not a serious matter as many large industrial states also do not report all their yellowcake transactions to the IAEA (an observation that is generally accurate). The Soviets maintain—with little justification—that to single out Libya on this small issue might cause Tripoli to withdraw from the NPT, thereby jeopardizing the ability to monitor Libyan acquisition of more sensitive nuclear materials.

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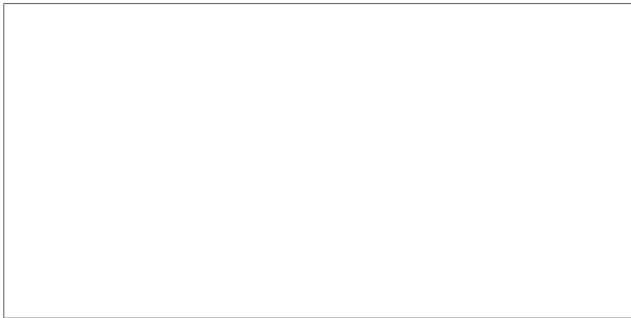
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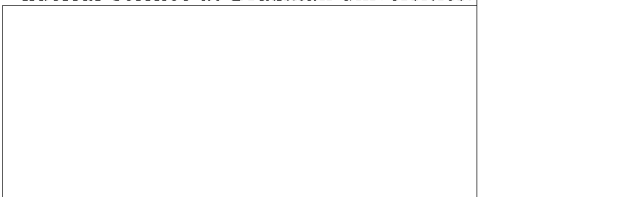
Links to Other Proliferators



Another troublesome aspect of Libya's nuclear activities is Tripoli's attempts to obtain nuclear assistance from other developing nations. We believe Libya's motives probably include:


- A desire to avoid restrictions on nuclear transfers often imposed by industrial nations.
- An effort to obtain equipment and materials without having to submit to IAEA safeguards.
- An interest in using nuclear trade to strengthen ties to important developing nations.


Libya's strategy, thus far, appears to have had limited success. None of the nuclear materials, equipment, or technology that Libya has acquired from developing nations would make a significant contribution to a nuclear weapons capability. Nevertheless, Tripoli has succeeded in the last few years in establishing nuclear ties with several developing countries. 

A cooperative arrangement between Brazil and Libya provides perhaps the best example of Libya's recent efforts to obtain Third World nuclear assistance. Under the provisions of a 1981 nuclear cooperation agreement, the Brazilians are conducting an aerial survey to locate uranium deposits in Libya. Other parts of the agreement enable Libyans to study nuclear science at Brazilian universities. 



 The Libyans might try to use their purchases of Brazilian arms—over \$350 million during 1977-81—as a lever to persuade Brasilia to provide nuclear assistance, but we doubt that this tactic will be successful. 

The Libyans in the past year have worked to develop relations with Argentina and, in the process, may have tried to inject new life into a nuclear cooperation agreement concluded with Buenos Aires nearly eight years ago. The agreement provides for Argentine assistance in uranium exploration and extraction as well as technical training for Libyan students in Argentine universities. There has never been any information that the agreement was implemented, but we believe that Tripoli may press Buenos Aires to be more forthcoming in return for Libya's assistance in obtaining military hardware during the Falklands conflict. 

Argentina could supply Libya with the basic technology for fabricating reactor fuel, a small light water research reactor, and training in the reprocessing of spent fuel. Should the Libyans take steps to acquire a heavy water nuclear fuel cycle, Argentina's potential role could be quite significant. Argentine firms could provide considerable technical assistance and could export heavy water by the late 1980s. Although we believe Buenos Aires has not made any commitments to Tripoli, the possibility of cooperation remains strong over the long term in view of Argentina's pressing need for military hardware and longstanding policy of seeking customers for its infant nuclear export industry.⁸ 

We believe that Libya will continue to cultivate nuclear relationships with other developing countries in an effort to diversify its source of nuclear supply and gain access to equipment and technology that could eventually lead to a nuclear weapons capability. Such procurement efforts, however, could not pay major dividends for several years because:

- The oil glut has created a cash-flow problem for Libya and prevents the effective use of oil as a lever against potential nuclear suppliers.



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- Developing countries, such as Brazil or India, are willing or able to provide only limited nuclear assistance to Libya because of the priority they place on advancing their own burgeoning nuclear programs. [REDACTED]

Prospects

We believe Qadhafi's interest in attaining a nuclear weapons capability will remain strong in view of his desire to project Libyan influence and his continuing concern with counterbalancing the Israeli nuclear capability. However, technical constraints will probably ensure that for some time Qadhafi's desire to acquire or misuse nuclear technology for military purposes will exceed Libya's ability to do so. Although his pursuit of a nuclear weapons option justifies continued concern about the proliferation threat and

[REDACTED] we believe that the numerous constraints cited will prevent Libya from producing fissile material in sufficient amounts for a nuclear device in this decade and possibly much longer. [REDACTED]

Furthermore, several nontechnical considerations could slow the pace of the nuclear program. First, Qadhafi's attention and commitment to the development of a nuclear capability has probably been somewhat diffused by the growing domestic public criticism of his dangerous and expensive efforts to enhance his own international reputation. Although he has rarely been deterred by popular discontent, we believe public dissatisfaction with him has reached such an intensity that the problem is now a major preoccupation of the regime. The result has been to siphon away Qadhafi's energies and possibly to curb his drive to pursue any issues that fall outside this area of immediate political concern. [REDACTED]

A second factor that may impede the Libyan nuclear program is the Israeli attack on the Iraqi research reactor. This event triggered a sharp public reaction throughout the Arab world, including Libya, reflecting in large part the fear that the Israelis might target nuclear facilities in other Muslim countries. [REDACTED]

[REDACTED] Qadhafi probably believes that Israeli intelligence is watching the program closely and that Tel Aviv would not hesitate to launch an attack if it felt it had sufficient reason. The fact that Prime Minister Begin authorized such action against Iraq when it was still far from attaining a nuclear weapons capability has probably convinced the Libyans that almost any nuclear activity with a tangential connection to military applications could provoke a response from the Israelis. [REDACTED]

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